Small Business Innovation Research/Small Business Tech Transfer

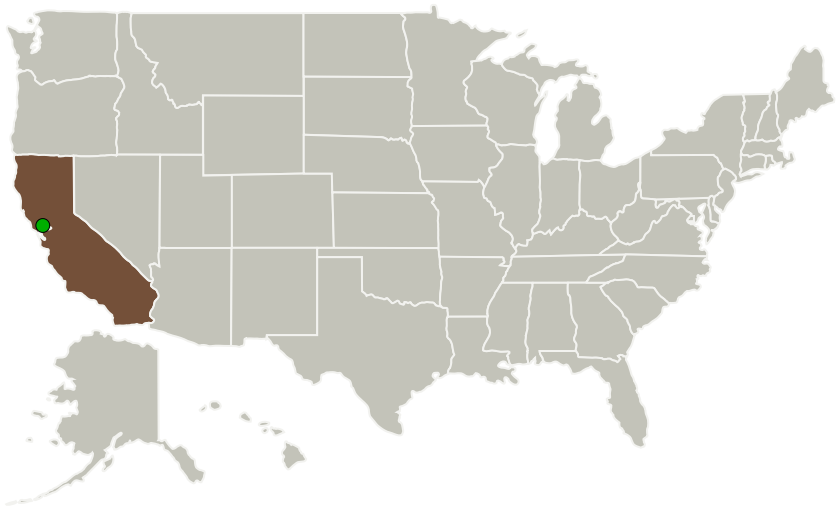
Heat Shield Recession Measurements Using Remote Spectral Sensors, Phase I

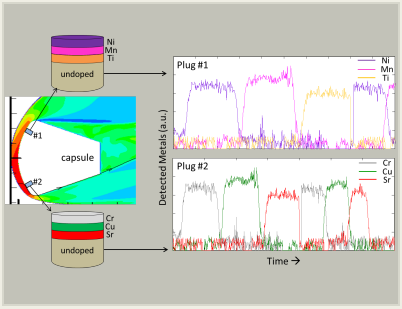
Completed Technology Project (2015 - 2015)

Project Introduction

OKSI proposes a minimally invasive in-flight diagnostic to measure heat shield recession during flight tests. These measurements can be used to validate models and ultimately optimize heat shield design to reduce weight while maintaining sufficient safety margins. The concept has two components: 1) specially designed heat shield plug(s) and 2) a remote spectral sensor. First, the custom heat shield plug will have trace amounts of different indicator materials that are released as pyrolysis/ablation progresses into the heat shield. Using different indicator materials at different depths allows the spectral sensor to detect when each layer is releasing the materials, providing a measure of both total recession depth and ablation rates. Using multiple plugs (each with different indicator material layers) allows a single spectral sensor to detect when each trace material is released into the flowfield. In this way, the spectral signature uniquely identifies the level of recession at the different spatial locations. The spectral sensor can either be located on the capsule viewing aft into the wake or located on a remote airborne platform tracking the capsule reentry. Each sensor location has its benefits and drawbacks. If the proposed concept is proven successful, NASA will have a minimally invasive heat shield recession diagnostic using onboard or remote spectral sensors. The concept will allow NASA to measure heat recession rates during all phases of reentry which will be especially useful for multiple reentry (skip trajectories) and differentiating recession levels for each reentry. Phase-I will utilize existing high fidelity models to predict signature levels and signal to noise ratio (SNR). Phase-I will also involve limited arc jet tests of doped Avcoat heat shield samples. During Phase-II, we will conduct more extensive arc jet testing to correlate spectral signatures with actual recession/pyrolysis.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Opto-Knowledge Systems, Inc.(OKSI)	Lead Organization	Industry	Torrance, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Transitions

June 2015: Project Start

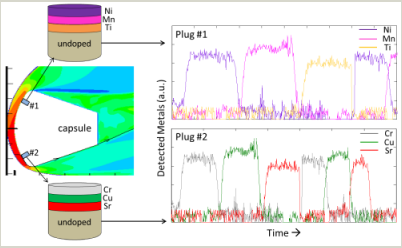
December 2015: Closed out

Closeout Summary: Heat Shield Recession Measurements Using Remote Spectral Sensors, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138903)*

Images



Briefing Chart Image
Heat Shield Recession Measurements Using Remote Spectral Sensors, Phase I *(https://techport.nasa.gov/image/137134)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Opto-Knowledge Systems, Inc. (OKSI)

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Gordon R Scriven

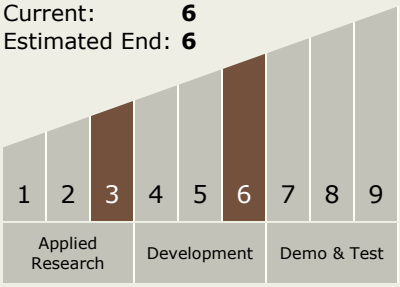
Co-Investigator:
Gordon Scriven

Heat Shield Recession Measurements Using Remote Spectral Sensors, Phase I

Completed Technology Project (2015 - 2015)

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.6 Instrumentation and Health Monitoring for EDL

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System